

What is claimed is:

1. A process for preparing butadiene from n-butane having the steps of
 - A) providing a feed gas stream a comprising n-butane;
 - B) feeding the feed gas stream a comprising n-butane into at least one first dehydrogenation zone and nonoxidatively catalytically dehydrogenating n-butane to obtain a product gas stream b comprising n-butane, 1-butene, 2-butene, butadiene, hydrogen, low-boiling secondary constituents and in some cases steam;
 - C) feeding the product gas stream b of the nonoxidative catalytic dehydrogenation and an oxygenous gas into at least one second dehydrogenation zone and oxidatively dehydrogenating 1-butene and 2-butene to obtain a product gas stream c comprising n-butane, 2-butene, butadiene, hydrogen, low-boiling secondary constituents and steam, said product gas stream c having a higher content of butadiene than the product gas stream b;
 - D) removing hydrogen, the low-boiling secondary constituents and steam to obtain a C₄ product gas stream d substantially consisting of n-butane, 2-butene and butadiene;
 - E) separating the C₄ product gas stream d into a recycle stream e1 consisting substantially of n-butane and 2-butene and a stream e2 consisting substantially of butadiene by extractively distilling and recycling the stream e1 into the first dehydrogenation zone;
 - F) if desired, feeding some or all of the stream e2 consisting substantially of butadiene into a selective hydrogenation zone and selectively hydrogenating butadiene to 1- and/or 2-butene to obtain a stream f comprising 1-butene and 2-butene;
 - G) if desired, feeding the stream f comprising 1-butene and 2-butene into a distillation zone and removing a product of value stream g1 consisting substantially of 1-butene to leave a stream g2 comprising 2-butene;

- H) if desired, recycling the stream g2 comprising 2-butene into the first dehydrogenation zone.
- 2. The process according to claim 1, wherein the noncatalytic dehydrogenation of n-butane is carried out autothermally.
- 3. The process according to claim 1 or 2, wherein the feed stream a containing n-butane is obtained from liquefied petroleum gas (LPG).
- 4. The process according to any of claims 1 to 3, wherein the extractive distillation is carried out using N-methylpyrrolidone as an extractant.
- 5. The process according to any of claims 1 to 4, wherein steps F) and G) are carried out.